CLAIMS

1. A turbine nozzle comprising:

a pair of hollow vanes fixedly joined to outer and inner bands, and each vane including opposite pressure and suction sides extending in span between said bands, and extending in chord between leading and trailing edges;

said trailing edge of a first one of said vanes forming with said suction side a second one of said vanes forward of said trailing edge thereof a throat of minimum flow area between said vanes;

each of said vanes further including identical patterns of outlet holes distributed over said pressure and suction sides thereof for discharging cooling air therefrom collectively at a reference flowrate through each vane;

said patterns of holes including multiple rows of showerhead holes bridging said leading edge, and two rows of gill holes spaced aft from said showerhead holes along said suction sides of said vanes;

a row of auxiliary holes spaced aft from said showerhead holes through said pressure side in each vane; and

said gill holes being sized to counterbalance added discharge of said cooling air through said auxiliary holes for maintaining said reference flowrate.

2. A nozzle according to claim 1 wherein said showerhead holes and auxiliary holes have substantially equal size, and said gill holes are larger.

3. A nozzle according to claim 2 wherein:

said showerhead holes and auxiliary holes have cylindrical configurations; and

said gill holes have diffusion configurations.

4. A nozzle according to claim 3 wherein:

each of said vanes includes a forward cavity behind said leading edge separated by a bridge from an aft cavity in front of said trailing edge; and

said gill holes include a forward row adjacent said showerhead holes and an aft row spaced aft therefrom adjacent said bridge, with both rows of gill holes being disposed in flow communication with said forward cavity for discharging said air therefrom.

5. A nozzle according to claim 4 wherein said forward and aft cavities include corresponding forward and aft impingement baffles for firstly impinging said cooling air against internal surfaces of said pressure and suction sides prior to discharge from said vanes through said outlet holes and auxiliary holes.

6. A nozzle according to claim 5 wherein said showerhead holes include one row along said leading edge, four rows along said suction side, and three rows along pressure side adjacent said row of auxiliary holes.

7. A nozzle according to claim 6 wherein said outlet hole pattern further comprises:

a row of trailing edge slots terminating at said trailing edge along said pressure side, and disposed in flow communication with said aft cavity for discharging said air therefrom;

one row of film cooling holes extending through said pressure side between said trailing edge slots and said aft cavity;

two rows of film cooling holes extending through said pressure side adjacent an aft end of said aft cavity; and

four rows of film cooling holes extending through said pressure side adjacent an aft end of said forward cavity.

8. A nozzle according to claim 7 wherein:

said showerhead holes consist of sixteen holes per row per vane between said outer and inner bands, each hole having a diameter of about 0.66 mm;

said auxiliary holes consist of sixteen holes per vane distributed between said outer and inner bands, each hole having a diameter of about 0.66 mm; and

said gill holes consist of twenty-five holes per row per vane between said outer and inner bands, each hole having an inlet diameter of about 0.76 mm.

9. A nozzle according to claim 8 wherein said aft rows of gill holes are disposed generally midway between said vane leading edges and said throat.

10. A nozzle according to claim 8 wherein said pattern of outlet holes is pre-existing, and said gill holes have modified configurations to counterbalance airflow from said auxiliary holes to form a derivative turbine nozzle having substantially the same discharge flowrate of said cooling air therethrough as said nozzle unmodified.

11. A turbine nozzle comprising:

a hollow vane including opposite pressure and suction sides extending in span between outer and inner bands, and extending in chord between leading and trailing edges;

said vane further including a pattern of outlet holes distributed over said pressure and suction sides for discharging cooling air therefrom collectively at a reference flowrate;

said pattern of holes including multiple rows of showerhead holes bridging said leading edge, and two rows of gill holes spaced aft from said showerhead holes along said suction side;

a row of auxiliary holes spaced aft from said showerhead holes through said pressure side; and

said gill holes being sized to counterbalance added discharge of said cooling air through said auxiliary holes for maintaining said reference flowrate.

12. A nozzle according to claim 11 wherein said showerhead holes and auxiliary holes have substantially equal size, and said gill holes are larger.

13. A nozzle according to claim 12 wherein:

said showerhead holes and auxiliary holes have cylindrical configurations; and

said gill holes have diffusion configurations.

14. A nozzle according to claim 13 wherein:

said vane includes a forward cavity behind said leading edge separated by a bridge from an aft cavity in front of said trailing edge; and

said gill holes include a forward row adjacent said showerhead holes and an aft row spaced aft therefrom adjacent said bridge, with both rows of gill holes being disposed in flow communication with said forward cavity for discharging said air therefrom.

15. A nozzle according to claim 14 wherein said showerhead holes include one row along said leading edge, four rows along said suction side, and three rows along said pressure side adjacent said row of auxiliary holes.

16. A nozzle according to claim 14 wherein said outlet hole pattern further comprises:

a row of trailing edge slots terminating at said trailing edge along said pressure side, and disposed in flow communication with said aft cavity for discharging said air therefrom;

one row of film cooling holes extending through said pressure side between said trailing edge slots and said aft cavity;

two rows of film cooling holes extending through said pressure side adjacent an aft end of said aft cavity; and

four rows of film cooling holes extending through said pressure side adjacent an aft end of said forward cavity.

17. A nozzle according to claim 14 wherein:

said showerhead holes consist of sixteen holes per row between said outer and inner bands, each hole having a diameter of about 0.66 mm;

said auxiliary holes consist of sixteen holes distributed between said outer and inner bands, each hole having a diameter of about 0.66 mm; and

said gill holes consist of twenty-five holes per row between said outer and inner bands, each hole having an inlet diameter of about 0.76 mm.

18. A nozzle according to claim 14 wherein said forward and aft cavities include corresponding forward and aft impingement baffles for firstly impinging said cooling air

against internal surfaces of said pressure and suction sides prior to discharge from said vane through said outlet holes and auxiliary holes.

19. A nozzle according to claim 14 wherein said pattern of outlet holes is pre-existing, and said gill holes have modified configurations to counterbalance airflow from said auxiliary holes to form a derivative turbine nozzle having substantially the same discharge flowrate of said cooling air therethrough as said nozzle unmodified.

20. A nozzle according to claim 14 further comprising:

a pair of said vanes fixedly joined to said outer and inner bands in an arcuate nozzle segment therewith;

said trailing edge of a first one of said vanes forming with said suction side of a second one of said vanes forward of said trailing edge thereof a throat of minimum flow area between said vanes; and

said aft row of gill holes being disposed generally midway between said vane leading edges and said throat.